



## FEDERAL COMMUNICATIONS COMMISSION

### 47 CFR Part 15

[ET Docket No. 20-36; FCC 20-156; FRS 17403]

#### Unlicensed White Space Device Operations in the Television Bands

**AGENCY:** Federal Communications Commission.

**ACTION:** Proposed rule.

**SUMMARY:** In this document, the Commission seeks comment on the use of a terrain-based propagation model such as Longley-Rice for determining white space channel availability and seeks to develop a record on whether or not to implement such a model. In particular, the Commission seeks comment on the effect use of such a model would have on availability of channels for white space devices, how a terrain-based model such as Longley-Rice could be implemented within the current white space device framework, the technical parameters necessary to use such a model for identifying available spectrum while protecting incumbents from harmful interference, and various database and device implementation issues.

**DATES:** Comments are due on or before [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]; reply comments are due on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

**ADDRESSES:** You may submit comments, identified by ET Docket No. 20-36, by any of the following methods:

- Federal Communications Commission's Web Site: <http://apps.fcc.gov/ecfs/>. Follow the instructions for submitting comments.
- People with Disabilities: Contact the FCC to request reasonable accommodations (accessible format documents, sign language interpreters, CART, etc.) by e-mail: [FCC504@fcc.gov](mailto:FCC504@fcc.gov) or phone: 202-418-0530 or TTY: 202-418-0432.

For detailed instructions for submitting comments and additional information on the rulemaking process, see the SUPPLEMENTARY INFORMATION section of this document.

**FOR FURTHER INFORMATION CONTACT:** Hugh Van Tuyl, Office of Engineering and Technology, 202-418-7506, [Hugh.VanTuyl@fcc.gov](mailto:Hugh.VanTuyl@fcc.gov).

**SUPPLEMENTARY INFORMATION:** This is a summary of the Commission's further notice of proposed rulemaking (FNPRM), in ET Docket No. 20-36, FCC 20-156, adopted on October 27, 2020, and released on October 28, 2020. The full text of this document is available for public inspection and can be downloaded at: <https://www.fcc.gov/document/fcc-increases-unlicensed-wireless-operations-tv-white-spaces-0> or by using the search function for ET Docket No. 20-36 on the Commission's ECFS web page at [www.fcc.gov/ecfs](http://www.fcc.gov/ecfs).

## **Synopsis**

1. *Discussion.* The Commission addresses Dynamic Spectrum Alliance, Wireless Internet Service Providers Association (WISPA), and Public Interest Spectrum Coalition arguments that the Commission should determine white space channel availability using a terrain-based model, such as the Longley-Rice Irregular Terrain Model (Longley-Rice model), which they assert will determine channel availability more accurately than the current contour-based model used by the Commission. For example, a terrain-based model could permit a white space device to deploy at a location where the television signal is shielded by a large hill or mountain, whereas the existing methodology does not account for such shielding. National Association of Broadcasters (NAB) and Sennheiser, however, oppose using the Longley-Rice model due to concerns about its accuracy in protecting TV receivers and because it may slow operation of the white space database.

2. *Current protection model.* Under current rules, white space devices must generally operate outside the defined co-channel and adjacent channel television station protected contours. The rules provide a table of separation distances beyond the protected contour that white space devices must meet that is based on the white space device's equivalent isotropic radiated power (EIRP) and height above average terrain (HAAT). These distances are based on a desired-to-undesired (D/U) signal ratio of 23 dB at the edge of the protected contour for co-channel operation, and -33 dB at the edge of the protected contour for adjacent channel operation, with a 14 dB allowance for TV receive antenna front-to-back ratio. The distances were calculated using the F(50,10) curves for separation distances of greater than 15 kilometers, the F(50,50) curves for separation distances of 1.5 to 15 kilometers, and the TM-91-1

model for separation distances of less than 1.5 kilometers.

3. *Longley-Rice model.* The Longley-Rice model is used to make predictions of radio signal field strength using the median attenuation calculated as a function of distance and the signal variability in time and space. The model can be run in point-to-point mode where it examines a specific radio signal path between a transmitter and a receiver, or in area mode in which it predicts field strength at many geographic points within a specified area. Each operational mode uses a terrain elevation profile in making predictions; in the point-to-point mode path-specific parameters can be determined from the terrain profile between the transmitter and receiver, and in area mode the elevation profile between the transmitter and each specific reception point is examined. The model may require a large number of reception points to be individually examined. It also requires a large set of input parameters encompassing system parameters (e.g., frequency, polarization, antenna heights), environmental parameters (e.g., terrain irregularity, electrical ground constants, surface refractivity, climate information), deployment parameters, and statistical parameters (e.g., reliability and confidence level). Based on the predicted radio signal attenuation and using additional factors such as transmitter power and antenna directivity, the D/U signal ratio can be estimated and compared against the 23 dB co-channel and -33 dB adjacent channel standards used as the basis when developing the white space device rules to predict whether harmful interference is likely to occur to television reception.

4. The Longley-Rice model can be implemented using a variety of methodologies. For example, the area subject to calculation can be divided into rectangular cells, e.g., a 1-by-1 kilometer grid, and the field strength predictions are calculated at a point in each cell, such as the geographic center or the population centroid. The Commission notes that as computing power has increased over the years, it is most common to execute the model in point-to-point mode and use a batch process to evaluate each grid cell within a specified area. Nevertheless, the Commission seeks comment on various implementations for white space device evaluation which include both area and point to point mode as it is concerned about the available processing power, capabilities and time requirements to run many simultaneous batch processes to evaluate a large number of white space devices that may query the database for available channel information at the same time. The Commission seeks comment on whether it should specify a specific operational mode and how the model should be implemented under a specific mode or both

operational modes.

5. As a threshold matter, the Commission seeks comment on whether using a terrain-based model, and in particular the Longley-Rice model, would better serve the white space device community as well as television broadcasters and other protected entities in the television bands. Commenters should specify the pros and cons of their preferred approach as it relates either to the Commission's existing contour method or other terrain-based propagation models. The Commission seeks comment on how the Longley-Rice model could be used to determine available white space channels. Would it be used only to determine if a white space device at a specific geographic location and power level meets the co- and adjacent channel D/U ratios? Or should the propagation model be used for wider applicability such as for determining separation distances necessary to ensure other protected entities such as licensed wireless microphones, television translator receive sites, cable headends, and land mobile stations do not experience harmful interference? In such cases, what criteria should be used to determine the protection distances? Should D/U ratios be used here too, or some other metric such as an interference-to-noise ratio? Commenters should provide detailed technical reasoning regarding how the metric they support achieves the necessary protection levels. In addition, the Commission seeks comment on whether the propagation model can be used to determine which areas are "less congested" and thus subject to more flexible rules. In this case, what criteria should be used as the basis for determining a "less congested" area as it relates to use of the propagation model? Could using the Longley-Rice propagation model for this purpose permit additional areas to be designated as "less congested" to provide more flexibility for white space devices? Similarly, the Commission seeks comment on whether the propagation model can be applied not only to fixed white space devices, but also to personal/portable, mobile and narrowband IoT white space devices. In each context, are there specific provisions required for how the model is implemented to account for the different white space device operational modes and use cases?

6. What mode—point-to-point or area—is appropriate for each situation? For fixed white space devices, it would seem intuitive to use the point-to-point mode to examine a specific radio path to the television station contour. However, the Commission seeks comment on what specific path should be examined—the shortest path to the contour or possibly a different path where the white space device and television contour are further apart, but due to terrain shielding effects, may have less attenuation. How

would each path be determined and how many specific paths would need to be evaluated before a determination can be made as to whether a channel is available for white space device use? Or would it be better to run the propagation model in area mode to determine the points along the television contour with the highest co- and adjacent channel D/U ratios and then run the model again in point-to-point mode for those specific transmission paths? Should a D/U threshold be set to determine which paths need further examination? If so, how close to the 23 dB co-channel and -33 dB adjacent channel thresholds do they need to be? And if an initial area mode calculation must be performed, what grid size is appropriate and what point within each grid cell should be used for analysis purposes? Using similar logic, how could the model be applied to determine “less congested” areas and operating locations for personal/portable, mobile or narrowband white space devices? Should it be run only in area mode or must additional point-to-point calculations also be performed? Commenters should provide detail regarding how the model can be applied to each of the situations likely to be encountered for various white space device types.

7. The Commission also seeks comment on whether the Longley-Rice model would always determine the same or shorter separation distances from a TV contour than the current model, or whether there are cases where it could require greater separation distances, and therefore reduce white space device channel availability. How justified are the concerns expressed by the NAB regarding the use of the Longley-Rice model to protect television reception? NAB argues that the Longley-Rice model requires transmitter and receiver locations to be known with precision, while television receiver locations are not reflected in any database and cannot be passively detected, and that current television receiver protection requirements for white space devices are not overly conservative or based on worst-case assumptions. The Commission seeks comment on NAB’s assertions. Commenters that favor use of the Longley-Rice model should provide specific reasons regarding how NAB’s concerns can be addressed.

8. The Commission further seeks comment on whether the Longley-Rice model should be the exclusive means of determining white space channel availability, or whether it should be an optional alternative to the current protection model. As an alternative model, would it be more appropriate to use the Longley-Rice model in combination with other propagation models in some circumstances such as the Commission requires for 6 GHz unlicensed devices, where different propagation models are specified at

different distances? Finally, the Commission seeks comment on whether the Longley-Rice model can or should be used for modeling the TV coverage itself, and therefore possibly allowing white space device operation within a TV protected contour as calculated using the F(50,90) curves so long as the minimum D/U ratios are met.

9. The Commission also seeks comment on the technical requirements that need to be specified if the Commission permits the use of the Longley-Rice model. What inputs are necessary for using the model in either point-to-point mode or area mode for each white space device type, potential use situation as well as for determining “less congested” areas and protection distances for each type of protected entity? Which of these inputs should be specified by rule and which can be determined either by the white space device operator or the database? Commenters should be as specific as possible regarding their preference for input parameters and provide engineering justification for those preferences. What grid size and which location within each grid cell should be used for determining white space channel availability?

10. The Commission further seeks comment on the terrain database that should be used with the Longley-Rice model or any alternative terrain-based model that the Commission specifies. Should the Commission require the use of a particular terrain database, such as one based on 3-arc second data or 1-arc second data? Should the Commission instead simply specify some minimum criteria for a terrain database, e.g., granularity, and allow the use of any terrain database that meets or exceeds that criteria?

11. *Model Implementation.* The Commission seeks comment on the various implementation factors that must be considered if the Commission adopts rules to allow the use of the Longley-Rice model or another terrain-based propagation model. As an initial matter, the white space database administrator would need time to implement this change to its system. How long should the Commission provide for the database administrator to implement these necessary changes? What type of testing should be performed to ensure that a white space database using a terrain-based model provides accurate results? Should the Commission perform its own testing or should it require public testing as it did when initially designating white space database administrators? The Commission also seeks comment on any effect that these changes might have on database and network performance. If the amount of overhead data necessary to use the Longley-Rice model significantly increases over what is necessary under the

existing rules, would the result be slower response times as Sennheiser suggests? If so, would this detrimentally affect the utility of white space devices? Would such changes affect the capacity of the database to handle large numbers of white space devices simultaneously?

12. Are changes needed to white space devices if the database is modified to base channel availability on the Longley-Rice model? Does the information sent from white space devices to the database need to change from the data set currently sent? If so, could all existing devices be updated? If not, how should the database deal with devices that can send the necessary data and those that cannot? Should the Commission require that devices be updated within a specific time period? What should that time period be? Would any of the needed changes to a white space device affect its emissions and necessitate a change to its equipment authorization records?

13. How would the database using the Longley-Rice model account for any device location uncertainty? What actions should be taken if the propagation model determines that an existing operational white space device on a specific channel based on current protection distances no longer meets the D/U ratios after performing the required calculations? Should that device no longer be permitted to operate on that channel at its current power level or could the existing separation distances specified in the rules be considered a safe harbor for operations?

14. The operational changes and effects of implementing the Longley-Rice model for determining white space device channel availability range from technical and modelling considerations to specific model implementation factors to database and device matters. The Commission asks that commenters comprehensively examine all aspects of the rule changes that would be needed and the effect they would have if it were to modify the white space device rules to specify use of the Longley-Rice model rather than the current contour-based method of protecting television stations and other protected entities in the TV bands.

## **PROCEDURAL MATTERS**

15. *Paperwork Reduction Act Analysis.* This document contains new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. It will be submitted to the Office of Management and Budget (OMB) for review under Section

3507(d) of the PRA. OMB, the general public, and other Federal agencies will be invited to comment on the new or modified information collection requirements contained in this proceeding. In addition, the Commission notes that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4), it previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

16. *Initial Regulatory Flexibility Analysis.* As required by the Regulatory Flexibility Act, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities of the proposals addressed in this FNPRM. The Full IRFA is found in Appendix D at <https://www.fcc.gov/document/fcc-increases-unlicensed-wireless-operations-tv-white-spaces-0>. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines for comments on the FNPRM, and they should have a separate and distinct heading designating them as responses to the IRFA. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of this FNPRM, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration, in accordance with the Regulatory Flexibility Act.

17. The Commission requests written public comment on the IRFA. Comments must be filed in accordance with the same filing deadlines as comments filed in response to the FNPRM and must have a separate and distinct heading designating them as responses to the IRFA. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of this FNPRM, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration, in accordance with the Regulatory Flexibility Act.

18. *Ex Parte Presentations.* The proceeding this FNPRM initiates shall be treated as a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules. Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting



at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule §1.1206(b). In proceedings governed by rule §1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.*, .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

19. *Filing Requirements.* Pursuant to §§ 1.415 and 1.419 of the Commission's rules, 47 CFR 1.415, 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS). *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- *Electronic Filers:* Comments may be filed electronically using the Internet by accessing the ECFS: <http://apps.fcc.gov/ecfs/>.
- *Paper Filers:* Parties who choose to file by paper must file an original and one copy of each filing.

Filings can be sent by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.
- U.S. Postal Service first-class, Express, and Priority mail must be addressed to 45 L Street NE, Washington, DC 20554.
- Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19. See FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy, Public Notice, DA 20-304 (March 19, 2020). <https://www.fcc.gov/document/fcc-closes-headquarters-open-window-and-changes-hand-delivery-policy>.

20. *People with Disabilities:* To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to [fcc504@fcc.gov](mailto:fcc504@fcc.gov) or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).

## **ORDERING CLAUSES**

21. Accordingly, IT IS ORDERED, pursuant to Sections 4(i), 201, 302, and 303 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 201, 302a, 303, that this *further notice of proposed rulemaking* is hereby ADOPTED.

22. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this *further notice of proposed rulemaking*, including the Initial Regulatory Flexibility Analyses, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

**Marlene Dortch,**  
*Secretary.*

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